# COURSE OUTLINE

## 1. GENERAL

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|---|---|---|---|
| **SCHOOL** | Environment and Agricultural Engineering | | |
| **ACADEMIC UNIT** | Natural Resources Management and Agricultural Engineering | | |
| **LEVEL OF STUDIES** | Undergraduate | | |
| **COURSE CODE** | 172 | **SEMESTER** | 5th |
| **COURSE TITLE** | Fluid mechanics – Applied hydraulics | | |

| **INDEPENDENT TEACHING ACTIVITIES** *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits* | **WEEKLY TEACHING HOURS** | **CREDITS** |
|---|---|---|
| Theory | 3 | 3 |
| Laboratory | 2 | 2 |
| | | |
| TOTAL: | 5 | 5 |

| | |
|---|---|
| **COURSE TYPE** *general background, special background, specialised general knowledge, skills development* | general background |
| **PREREQUISITE COURSES:** | None |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | YES (In English) |
| **COURSE WEBSITE (URL)** | |

## 2. LEARNING OUTCOMES

**Learning outcomes**

*The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.*

*Consult Appendix A*

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The course is a basic one in the scientific field of Natural Resources Management. It aims to introduce students to the basic concepts of Fluid Mechanics as the general properties of fluids, hydrostatics and hydrodynamics.

Second aim of the course is the understanding of Applied Hydraulics importance in the management of water resources and environmental protection as well as in the design of the related projects.

Upon successful completion of the course the student will be able to:

• Calculate the basic parameters in hydrostatics problems.
• Study the flow in pipes and open channels.
• Understand the following lessons of hydraulic design, land improvement, irrigation - drainage systems and hydrology

**General Competences**

*Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?*

| | |
|---|---|
| *Search for, analysis and synthesis of data and information, with the use of the necessary technology* | *Project planning and management* |
| *Adapting to new situations* | *Respect for difference and multiculturalism* |
| *Decision-making* | *Respect for the natural environment* |
| *Working independently* | *Showing social, professional and ethical responsibility and sensitivity to gender issues* |
| *Team work* | *Criticism and self-criticism* |
| *Working in an international environment* | *Production of free, creative and inductive thinking* |
| *Working in an interdisciplinary environment* | *……* |
| *Production of new research ideas* | *Others…* |
| | *…….* |

- Search, analysis and synthesis of data and information with the use of the required technologies
- Independent Work
- Production of new research ideas
- Respect for the natural environment

## 3. SYLLABUS

**Basic knowledge**. Fluid Properties. Newtonian and non-Newtonian fluids, basic mathematical tools: vectors and tensors - fields.

**General Properties of Fluids:** Homogeneity, isotropy, Viscosity, Ideal and real fluids, Compressibility, Surface Tension. Pressure. Pressure in ideal fluids. Similitude and dimensional analysis. Compressible fluids: basic flow concepts.

**Hydrostatics**: Hydrostatic pressure, General equations of hydrostatics, pressure difference between two points. Pressure – depth relation. Practical pressure expression units. Measurement of hydrostatic pressure, pressure gauges, pipe pressure resistance, minimum thickness determination of metal tubes.

**Hydrodynamics:** General. Basic conservation laws of the fluid flow. Continuity equation, conservation of mass, conservation of momentum and energy. Ideal fluid motion equations. The theorem of Bernoulli. Applications of the theorem of Bernoulli (venturi-meter, Pitot tube, the Torricelli type). The theorem of motion quantity. Draining holes and valves. Weirs. Flow in closed conduits under pressure, flow items in closed conduits - Raynolds number, laminar and turbulent flow in closed conduits, boundary layer. Siphon flow. Load losses in closed conduits. Free surface flow. Critical flow. Definition of specific energy E, Specific Energy graphic presentation, flow types and critical flow. Equations of critical flow. Hydraulic jump. Typical applications of Critical flow in measurements.

**Computational Fluid Mechanics:** Applications and use of computational methods for the study of the flow. Typical examples (flow in closed conduit, flow behind obstacle), display of these examples through numerical simulations. Brief overview of computational methods for flow analysis.

## 4. TEACHING and LEARNING METHODS - EVALUATION

| | |
|---|---|
| **DELIVERY**<br>*Face-to-face, Distance learning, etc.* | The teaching methodology employed in the classroom involves active student participation through interactive question and answer sessions. |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**<br>*Use of ICT in teaching, laboratory education, communication with students* | Specialized software<br>e-class platform |
| **TEACHING METHODS**<br>*The manner and methods of teaching are described in detail.*<br>*Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials,* | |

| ***Activity*** | ***Semester workload (hours)*** |
|---|---|
| Lectures | 39 |

| | | |
|---|---|---|
| *placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.*<br><br>*The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS* | Exercises that focus on design application methodologies and laboratory measurements | 26 |
| | Small individual training work | 10 |
| | Theory study | 50 |
| | TOTAL | 125 |
| **STUDENT PERFORMANCE EVALUATION**<br>*Description of the evaluation procedure*<br><br>*Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*<br><br>*Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | I. Final written theory examination (50%) comprising:<br>- Multiple choice questions<br>- Open questions<br>- Problem solving<br>- Theory elements<br><br>II. Laboratory Grade (50%)<br>-Written final laboratory examination (40%) with numerical problems from laboratory exercises<br>- Individual exercises delivery (10%) | |

## 5. ATTACHED BIBLIOGRAPHY

Handbook of Applied Hydraulics, C.V Davis Editor in Chief, K. E. Sorensen, Co-Editor, Mc Graw-Hill Book Company.